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Plume-Catchers searching for signatures of life on the icy moons of Jupiter and Saturn

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Since the last decade the focus of NASA and ESA is set on the scientific fields of life detection and the reconnaissance of habitable environments on other planets and satellites like Mars, Europa, Enceladus and Titan. Recent and future missions like Curiosity, ExoMars and JUICE will continue this endeavor. In this highly significant and challenging field of research, a plume catcher mission will address relevant astrobiological topics, produce substantial insights and provide supplemental knowledge to support the search for life in the universe. Such a probe might be the best way to sample material what is coming from the inner part of the icy moons like Europa or Enceladus and to analyze it with a deep focus on complex organics with reference to the existence or non-existence of life. The search for life can be started by this way avoiding complex landing on the surface of the icy moons. To find life or the remnants of life just in plume material might be most likely, because we know about distinct volcanic and hydrothermal active places in the deep sea on Earth where a big variety of microorganisms and even more evolved organisms are living using the available energy in these areas. By the thermally driven high pressure on the moons such kind of life-relevant material can be ejected even through the plumes into space. So it is a reasonable consequence to collect such material and analyze it. Our proposal is the development of such kind of probe, a so called plume catcher and analyzer. But what does a so-called plume-catcher consist of and what does it need for analyzing the highly dynamic plumes with complex ingredients? – The answer might be that the orbiter has to be equipped with a funnel which has to pass regularly through the plumes of the icy moons capturing through each passing-by the plume material and accumulating the material in the inner side of the orbiter in specific glass sample collectors or aerogel where it can be analyzed by a set of spectroscopic instruments as there are (UV-) Raman, IR-, LIBS and Fluorescence-Spectroscopes. The set can be enlarged according to available budgets and might also consist of microscopes and labs on a chip.